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Developmental Biologists Ruth Lehmann, James Priess, and Geraldine Seydoux Share $500,000 Gruber Genetics Prize for Pioneering Discoveries Regarding the Molecular Mechanisms Involved in Embryonic Development

| Ruth Lehmann | James Priess | Geraldine Seydoux |

February 24, 2022, New Haven, CT — The 2022 Gruber Genetics Prize is being awarded to developmental biologists Ruth Lehmann, PhD, of the Whitehead Institute and the Massachusetts Institute of Technology, James Priess, PhD, of the Fred Hutchinson Cancer Research Center, and Geraldine Seydoux, PhD, of the Howard Hughes Medical Institute and the Johns Hopkins University, for their seminal contributions to identifying and understanding the molecular genetic mechanisms involved in the earliest stages of embryogenesis. Although working independently, the three scientists have together transformed the field of germ cell biology, the study of how germ cells (the precursors of eggs and sperm) faithfully transmit genetic information across generations–one of the most fundamental questions in genetics.

"As a result of their curiosity, innovation, and remarkable insights, each of these phenomenal scientists has played a pivotal role in unlocking the molecular mysteries of early embryonic development," says Eric Olson, professor at UT Southwestern and member of the Selection Advisory Board. "It's not an overstatement to say that their genetic findings regarding germ cells have helped to revolutionize modern developmental biology."

The Gruber Genetics Prize, which includes a $500,000 award, will be presented to Lehmann, Priess, and Seydoux, at a ceremony later this year.

Working primarily with the fruit fly *Drosophila melanogaster*, Lehmann made landmark discoveries regarding the composition, assembly and function of germ plasm within the embryo, including the central role of *oskar*. This research contributed to the first genetic framework for the specification of germ cell fate in any organism. Lehmann also helped uncover how oocyte mitochondria avoid transmitting

mutations within their small genomes to offspring and how they associate with germ plasm. Priess and Seydoux used a different model organism—the nematode *Caenorhabditis elegans*—in their research. Priess showed that early embryogenesis depended on intercellular signaling, similar to vertebrate embryogenesis, and developed an innovative genetic screening method to identify regulators of cell fate. Priess and his collaborators identified the PAR genes that specify embryonic polarity, and PIE-1, SKN-1, and MEX-1 that specify the fates of early embryonic cells, including germ cells. Seydoux discovered that early germ cells protect themselves from somatic cell influences by shutting down RNA transcription (using PIE-1 in *C. elegans*). She clarified how germ cell-associated particles, P granules, are organized and regulated by proteins such as MEG-3 to control the novel mechanism of phase separation. Her work has helped make P granules a model for understanding the role of phase separation in a wide variety of cellular structures.

"How our DNA allows a single fertilized egg cell to generate the vast complexity of our bodies is one of the greatest mysteries of life. By starting to chart this course near its beginning, Lehmann, Priess and Seydoux have demonstrated that embryonic development is within our powers to fully understand" says Allan Spradling, professor at the Carnegie Institution/HHMI and chair of the Selection Advisory Board.

Additional Information

In addition to the cash award, each recipient will receive a gold laureate pin and a citation that reads:

The Gruber Foundation proudly presents the 2022 Genetics Prize to Ruth Lehmann, James Priess, and Geraldine Seydoux for discovering how early nematode (Priess and Seydoux) and fruitfly (Lehmann) embryos set aside particular cells during development, especially germ cells that result in intergenerational inheritance.

Their research employed genetic screens and elegant molecular analyses to characterize mysterious "germ granules" located in oocytes and early embryos. Germ granules house mRNAs whose regulated translation and localization specify germ cells and protect them from premature transcription. Germ granules utilize a novel mechanism, phase separation, relevant to many other particulate cellular structures and to organismal development. These seminal genetic findings illuminated normal biology and furthered our understanding of nuclear inheritance, while highlighting the power of model organisms to reveal the mysteries of life.

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The Genetics Prize is presented to a leading scientist, or up to three, in recognition of groundbreaking contributions to any realm of genetics research.

Laureates of the Gruber Genetics Prize:

- **2021: Stuart H. Orkin,** revolutionized our understanding of genetics of inherited blood disorders
- **2020: Bonnie Bassler,** for pioneering discoveries on bacterial communication
- **2019: Bert Vogelstein,** discoveries of new genetic pathways and processes contributing to cancer
- **2018: Joanne Chory and Elliot Meyerowitz,** for helping revolutionize plant molecular biology, with implications for global agriculture, the environment, and human health and disease

- **2017: Stephen Elledge,** for discovering and characterizing the molecular mechanisms of the DNA damage response pathway in eukaryotic cells
- **2016: Michael Grunstein and David Allis,** for the discovery of the role of histone proteins and their covalent modification in the regulation of eukaryotic gene expression
- **2015: Emmanuelle Charpentier and Jennifer Doudna**, for establishing a framework for universal genome editing
- **2014: Victor Ambros, David Baulcombe, and Gary Ruvkun**, for pioneering the study of small non-coding RNA's, molecules that are recognized as playing a critical role in regulating gene expression
- **2013: Svante Pääbo,** for pioneering the analysis of ancient DNA
- **2012: Douglas C. Wallace,** for his groundbreaking contributions to mitochondrial genetics
- **2011: Ronald Davis,** for pioneering development and application of recombinant-DNA techniques
- **2010: Gerald Fink**, whose work in yeast genetics advanced the field of molecular genetics
- **2009: Janet Davison Rowley,** for her seminal discoveries in molecular oncology
- **2008: Allan C. Spradling,** for his work on fly genomics
- **2007: Maynard V. Olson,** for his contributions to genome science
- **2006: Elizabeth H. Blackburn,** for studies of telomeres and telomerase, and her science advocacy
- **2005: Robert H. Waterston,** for his pivotal role in the Human Genome Project
- **2004: Mary-Claire King,** for three major findings in modern genetics: the similarity of the human and chimpanzee genomes, finding a gene that predisposes to breast cancer, and forensic genetics.
- **2003: David Botstein,** a driving force in modern genetics who established the ground rules for human genetic mapping
- **2002: H. Robert Horvitz,** who defined genetic pathways responsible for programmed cell death
- **2001: Rudolf Jaenisch,** who created the first transgenic mouse to study human disease

The Prize recipients are chosen by the Genetics Selection Advisory Board. Its members are:

Aravinda Chakravarti, New York University, School of Medicine; **Philip Hieter,** Michael Smith Laboratories at the University of British Columbia; **Jeannie T. Lee**, Harvard Medical School; **James Lupski**, Baylor College of Medicine; **Eric N. Olson**, The University of Texas Southwestern Medical Center; **Allan Spradling**, Carnegie Institution for Science (Chair).

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The Gruber International Prize Program honors individuals in the fields of Cosmology, Genetics and Neuroscience, whose groundbreaking work provides new models that inspire and enable fundamental shifts in knowledge and culture. The Selection Advisory Boards choose individuals whose contributions in their respective fields advance our knowledge and potentially have a profound impact on our lives. The Genetics Society of America partners with the Foundation on the Genetics Prize, and nominates the members of the Genetics Selection Advisory Board.

The Gruber Foundation was established in 1993 by the late Peter Gruber and his wife Patricia Gruber. The Foundation began its International Prize Program in 2000, with the inaugural Cosmology Prize.

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For more information on the Gruber Prizes, visit www.gruber.yale.edu, e-mail info@gruber.yale.edu or contact A. Sarah Hreha at +1 (203) 432-6231. By mail: The Gruber Foundation, Yale University, Office of Development, PO Box 2038, New Haven, CT 06521.

Media materials and additional background information on the Gruber Prizes are in our online newsroom: www.gruber.yale.edu/news-media

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